

DETERMINE OPTIMAL STIMULUS AMPLITUDE FOR USING VESTIBULAR STOCHASTIC STIMULATION TO IMPROVE BALANCE FUNCTION

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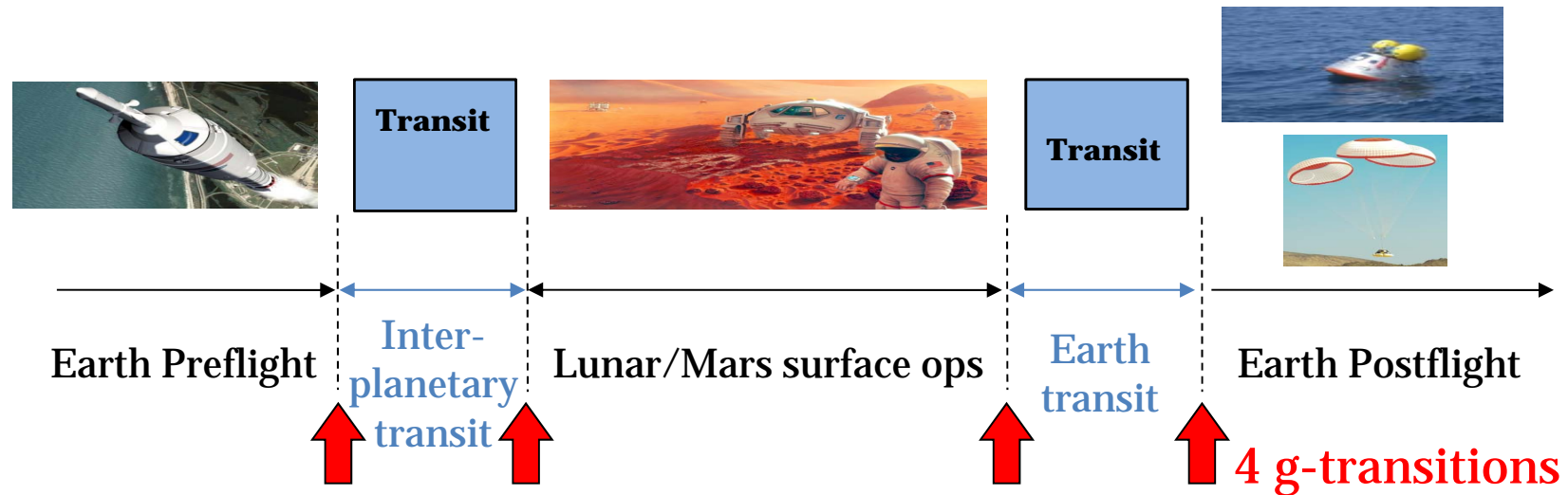
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Background

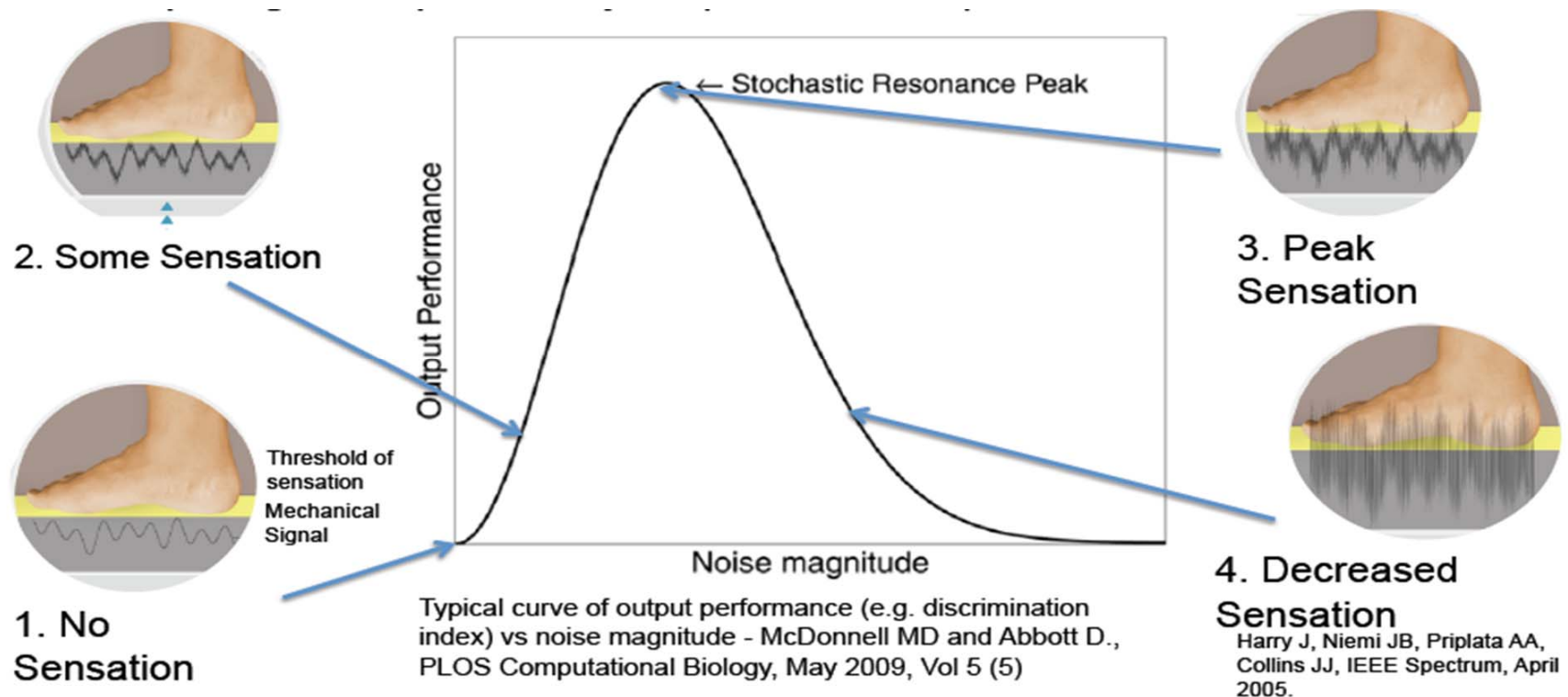


Background



- Adaptation to new environment (partial gravity)
- Sensorimotor changes such as postural and gait instabilities can affect the functional performance
- Sensorimotor training as a tool to improve adaptation

Background



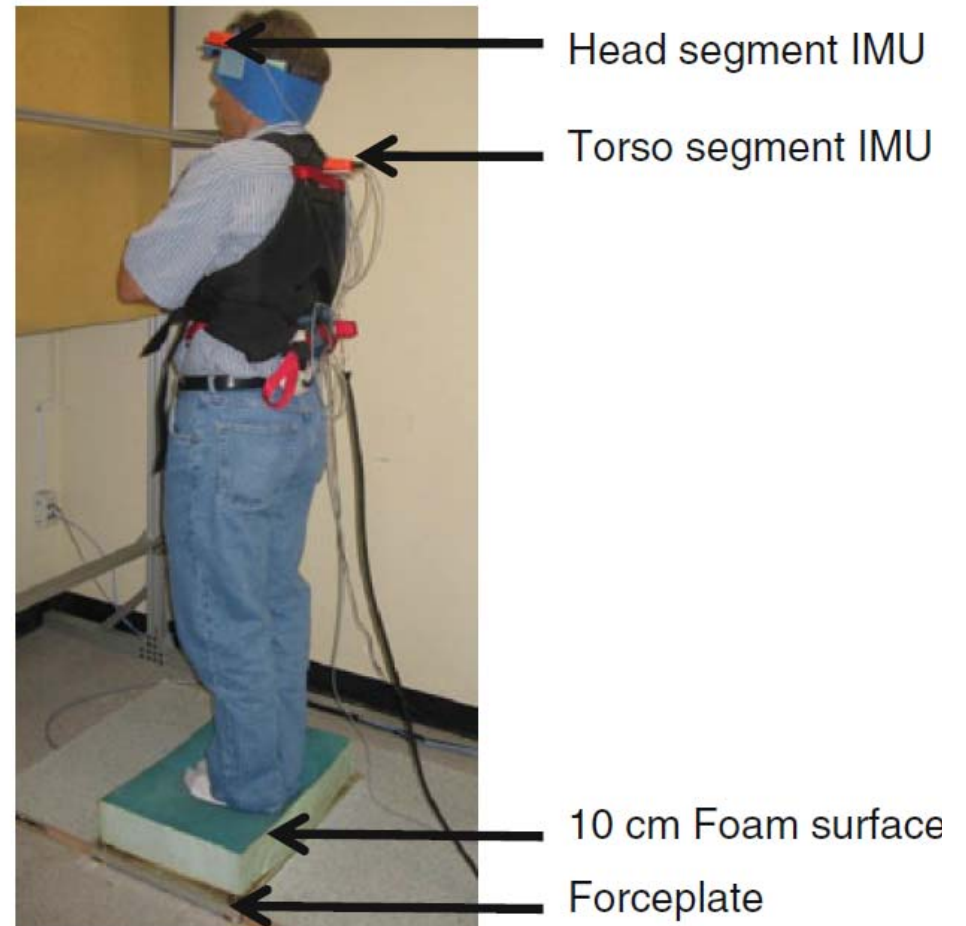
Low imperceptible levels of current enhance information transfer by Stochastic Resonance (SR) phenomenon

We hypothesize that vestibular SR will enhance the ability of crewmembers to adapt to changes in gravitational environments

Determine optimal stochastic
vestibular stimulation (SVS) to improve
balance performance

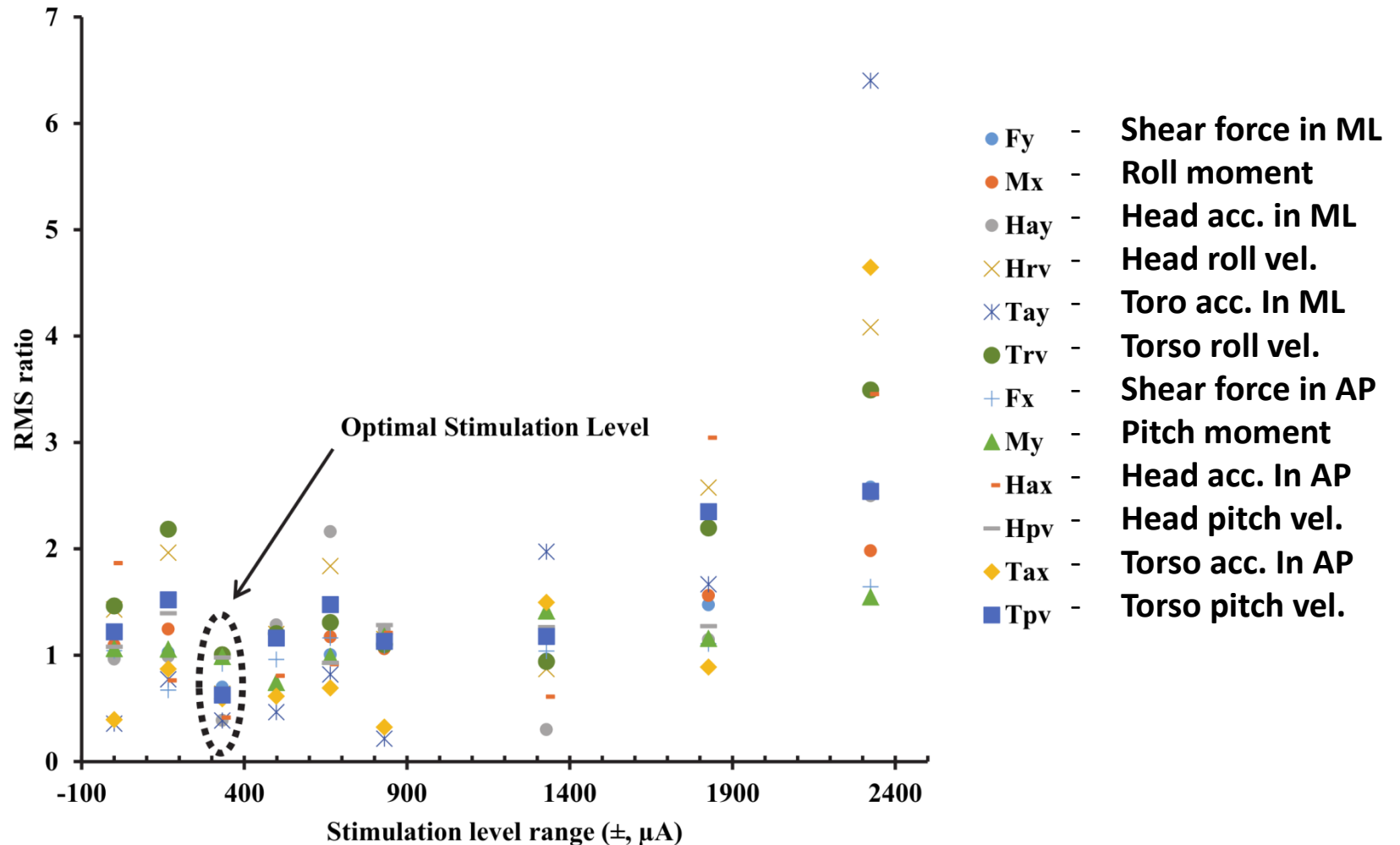
Balance Task

- Stimulation levels
 - 11 fixed stim levels (0,100,200,300,400,500,700,900,1100,1300, and 1500 μ A)
- 44s trial with both baseline and stimulation periods
- Feet together, eyes closed, arms crossed
- 10cm med-density-foam
- Measurements:-
 - Inertial Measurement Unit (IMUs)
 - Force plate



An example subject (Mulavara, 2011)

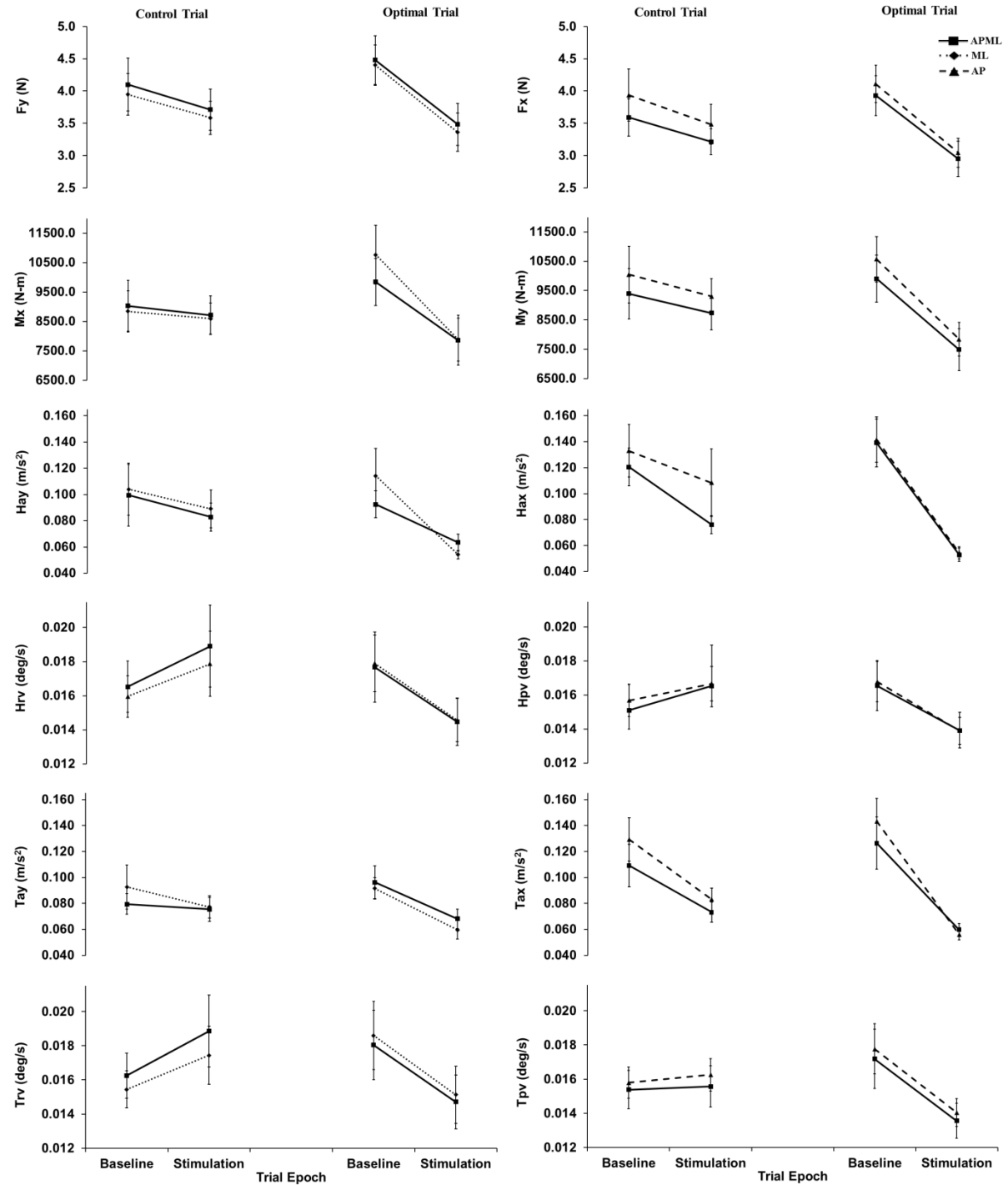
Typical Results – Balance Optimization (BO)



Normalized ratio data of all twelve variables in anterior-posterior (AP) and medio-lateral (ML) directions combined (APML), of root mean square (RMS) during the stimulus to the RMS during the baseline period

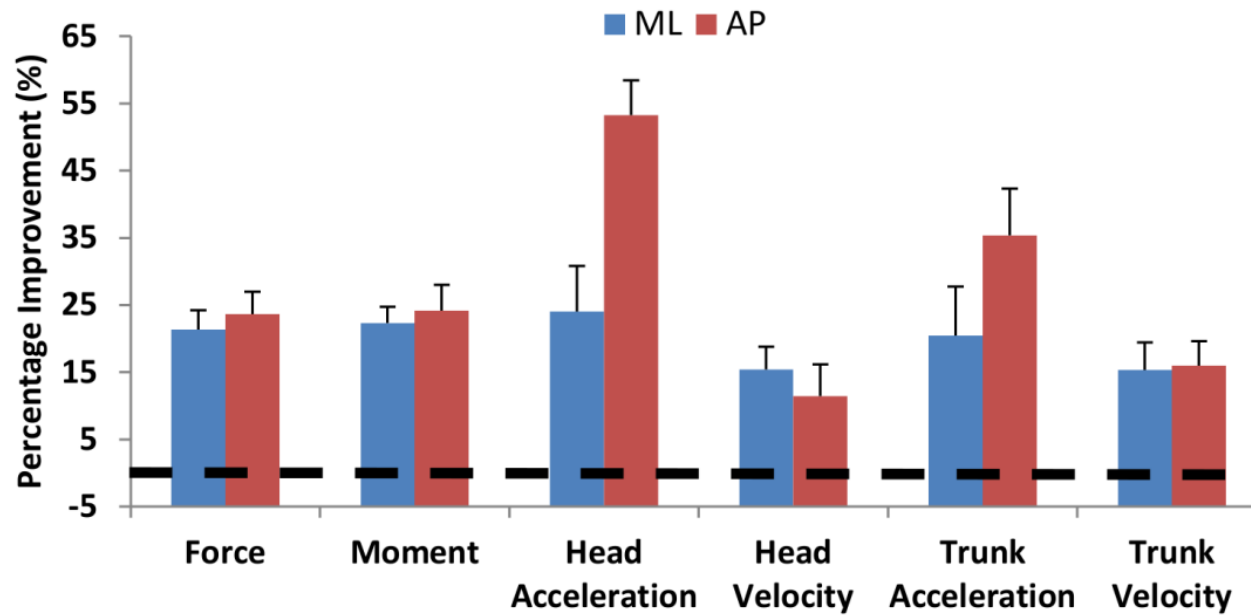
Results - BO

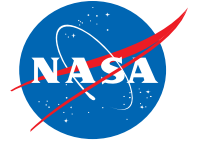
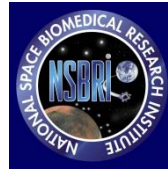
**Average (\pm SEM)
across all subjects
responsive to SVS
showing RMS values
of the six variables
of interest for ML,
and AP, and twelve
variables for APML**



Results - BO

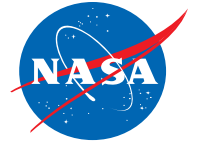
**Average Improvement in Balance Performance Across
AP and ML directions with SVS (n=24)**





Conclusions

- Low imperceptible levels of white noise based binaural bipolar electrical stimulation of the vestibular system improve balance performance in both ML and AP
- A SR based vestibular stimulation device may be fielded as a training modality to enhance adaptability or skill acquisition by increasing utilization of vestibular information



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